agricultural research

U.S DEPARTMENT OF AGRICULTURE DECEMBER 1974

agricultural research

December 1974/Vol. 23, No. 6

Protein from Leaves

The leaf is destined to play a vital role as a source of protein for our food-short planet. For centuries, most of mankind's supply of this critical nutrient has come from the seed of cereal plants, but the varieties eaten extensively only contain 7 to 12 percent protein. There is a far richer potential to be exploited in the world of green leaves—those food factories whose biochemical activities ultimately sustain all life. Few people realize that the leaf, depending on its kind and stage of maturity, on a dry matter basis contains 20 to 30 percent protein. Furthermore, the husbandry of leafy forage plants can provide us with the most food from the land and still safeguard it from erosion.

Alfalfa ranks as the ideal plant for producing leaf protein. It fixes nitrogen for its own growth, is a perennial that typically requires reseeding only every 4 to 10 years, thrives from Mexico to Saskatchewan, recovers within 28 days after cutting and, depending on locality, offers 3 to 11 cuttings a year.

ARS researchers are making significant progress in wresting protein from alfalfa for human diets. In work aimed at improving the present method of dehydrating alfalfa meal for livestock and poultry, they have developed a wet process—called the Pro-Xan II process—that sorts out the many valuable substances in alfalfa according to most efficient use. A key step in the wet process involves running fresh, chopped alfalfa through rolls to squeeze out a large volume of juice. From this juice the researchers eventually obtain two powdered products: a green carotene-xanthophyll concentrate for poultry feed, and a white protein concentrate for human food. The protein concentrate, with its good balance of amino acids, can serve as an ingredient for formulating high-protein flours, and for fortifying a wide range of snack and other foods.

A bright future lies ahead for alfalfa protein concentrate. In feeding forage to livestock, its conversion by the animal involves a protein loss of 80 to 90 percent. By contrast, the ARS wet process, at its present state of development, can capture one-third of the protein in alfalfa in fiber-free form. The remaining protein goes to livestock in the dehydrated meal. Certain technological problems remain to be solved—increasing the amount of protein extracted, for example, and removing impurities and off flavors in the protein concentrate. In time, however, agricultural science will exploit a new source of protein for a waiting world.

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Cover: Soil scientist Dan Champion checks the contact points on one of six mercury switches that are mounted on sprinklers in a research plot at Grand Junction, Colo. Scientists are altering the amount of water applied to irrigated crops in the Colorado River Basin to study salinity problems on the lands (0874R1403–16). Article begins on page 7.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), U.S. Department of Agriculture, Washington, D.C. 20250. Printing approved by the Office of Management and Budget through June 15, 1977. Yearly subscription rate is $5.05 in the United States and countries of the Postal Union, $6.35 elsewhere. Single copies are 45 cents. Send subscription orders to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use of commercial names and brands is for identification only and does not imply endorsement or approval by USDA or ARS.

Earl L. Butz, Secretary
U.S. Department of Agriculture

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Dr. Friedman inspects flame testing results on pieces of wool fabric. The material on the left was treated with the newly developed flame retardant (0974X1470–20).

Wool triumphs over flames

A new flameproofing treatment for wool, wool-blended fabrics, and nylon could help eliminate some of the 3,000 to 5,000 fatalities caused every year by flammable fabrics.

Recent tests show that tetrabromophthalic anhydride (TBPA) applied to fabric during dyeing is an effective flame retardant. Fabrics so treated will further reduce the fire hazard of clothing, blankets, carpets, and airline upholstery—the fabric uses for which flame resistance is most needed.

The new treatment is economical, easy to apply, non-irritating, and does not impair the dyeing process. Moreover, TBPA does not wash out of treated fabrics even after 10 dry cleanings and 10 hand washings in mild detergent at room temperature.

The TBPA treatment is economical because it can be applied during the regular dyeing process with no additional expense for equipment, labor, or floor space. In a typical dye application, the bath is heated to 120° to 125° F. Then dye assists, which give the fabric an even color, and the flameproofing compound are added, and the whole bath is heated for an additional 5 minutes. The amount of TBPA used is 8 to 12 percent of the weight of the cloth being treated.

Dye is added next. TBPA can be used

Ease of commercial adaptation is one of several economically appealing aspects of the textile treatment being developed by ARS scientists. Chemical engineer John Ash pours a solution containing the chemical flame-retardant into a dye bath at the Western Regional Research Center (0974X1471–11). ***Below left:*** *Testing for skin irritation, laboratory technician Dorothy Robbins applies a treated swatch of wool to a shaved portion of an adult Albino New Zealand rabbit. No skin irritation resulted from the test or with similar tests on humans (0974X1470–3).* ***Below right:*** *Dr. Friedman applies the flame retardant to wool fabric for a laboratory test (0974X1470–30).*

effectively wtih several common dye types. Finally, fabric is added and the bath brought gradually to a boil. It takes 35 to 40 minutes for complete color penetration with light shades and up to 1½ hours for dark shades. The time varies depending upon the type of dye, fabric, and machine used.

Although the chemistry of the interaction between TBPA and wool remains to be studied, the scientists think that the binding process is analogous to that which takes place in dyeing. Nevertheless, they have noted no competition between the dye and TBPA for binding sites on the fabric.

No additional time is used for the flameproofing treatment over usual dyeing. Also, there should be no expensive recovery operation or disposal problem because the fabric takes up practically all the added chemical.

Upon ignition, the treated wools completely extinguish themselves in a vertical flame test, standard laboratory evaluation.

The TBPA treatment, developed by ARS chemist Mendel Friedman and chemical engineers Willie Fong and John F. Ash at the Western Regional Research Center, Berkeley, Calif., causes no color change when exposed to heat. The process has no noticeable effect on the shades of dyes. All colors are as brilliant and deep as untreated fabrics dyed with the same concentration of dye.

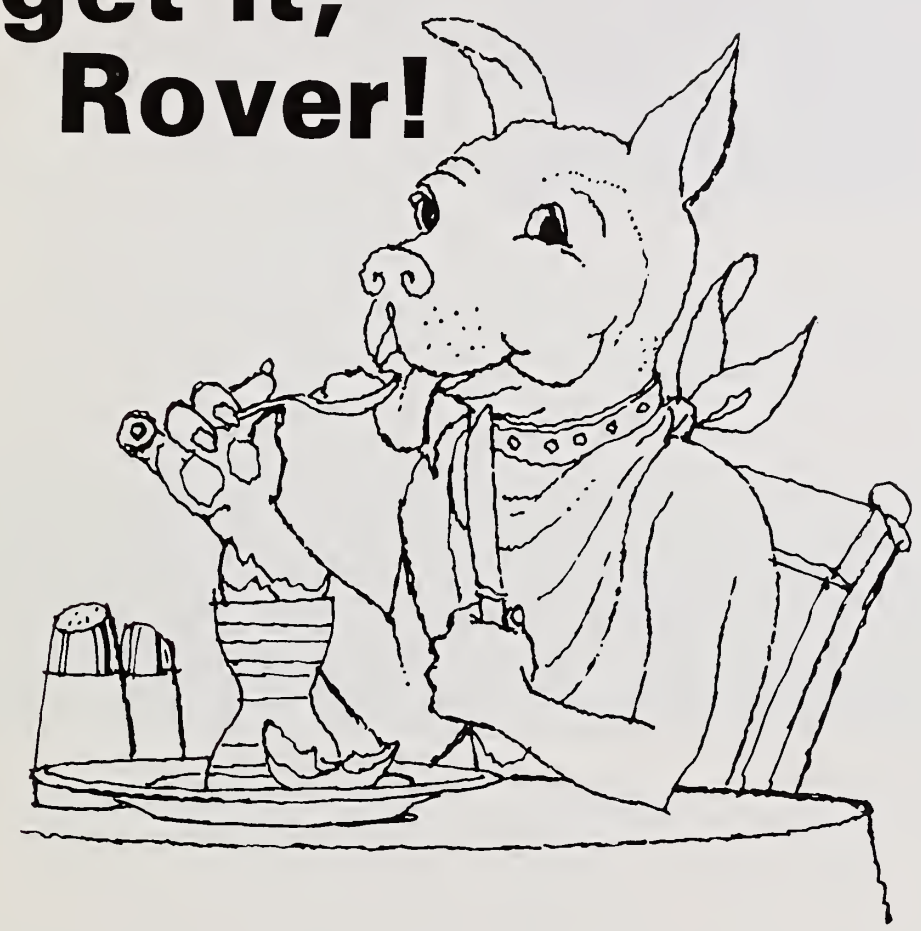
"This process is extremely economical not only because of its routine, easy application with no need for additional machinery, but also because the chemical itself is cheap—about 10 cents worth of TBPA treats an ordinary skirt," Dr. Friedman said.

The treatment has little or no effect on fabric softness. Dresses and suits manufactured from these flameproof fabrics should be every bit as comfortable as garments from untreated fabrics.

Treated fabrics appear not to cause skin irritation. A laboratory test animal, an adult Albino New Zealand rabbit with a treated swatch taped to its shaved back, did not show signs of skin irritation. Also, when a 1-inch square patch was taped to a human's inner forearm for 14 hours, there was no adverse effect.

Additional tests, conducted in cooperation with the Stored Product Insects Research and Development Laboratory, Savannah, Ga., reveal that the treated wools are more moth resistant than untreated fabric. Entomologist Roy E. Bry conducted tests that showed carpet beetle larvae ate 50 percent less of the treated wool than the untreated fabric over a 14-day period. □

Come and get it, Rover!



FIFTEEN canine gourmets literally lapped it up—an experimental specialty dog food recipe using unrefrigerated waste egg meats. Broken, smashed, or overheated during the washing process, waste eggs from a typical egg-grading plant can be profitably used, and more important, they may no longer be a pollutant that plagues the egg industry.

Many grading plants pour waste wash water into any available sewer system, but inedible egg liquids and solids most often go to the city dump. "This type of refuse is particularly obnoxious, especially when a day old. City officials don't welcome rotten egg wastes in their sanitary landfills," said ARS chemist Douglas Hamm.

Scientists may have found a way to make egg wastes pay instead of pollute. "We have over 6,000 grading plants in the United States, but most of them do not generate enough of the waste product in any one day to make collection feasible," Dr. Hamm added. "And most grading plants have only cool storage—10 to 15° C. But if we acidify the product, keep it fresh and usable for a week, collection could be effective and economical. Grading plants may be 50 miles apart, but by storing processed egg meats for later delivery, we can appreciably reduce pollution and come out with a marketable by-product."

Researchers previously noted that egg washer water containing about 4 percent egg solids did not develop a putrid odor when acidified to pH 4.5, even when left in an open container on the laboratory bench for several days. The same technique was applied on waste egg products collected at a commercial egg grading plant.

Among various trial experiments, researchers studied the influence of acidity and temperature on the storage life of waste egg meats, and the practicability of using them in a pet food formulation. Dr. Hamm and his colleagues at the Richard B. Russell Agricultural Research Center, Athens, Ga., acidified egg meats with 3.4 normal hydrochloric acid and successfully stored them up to 10 days in a 13° C. egg-holding room.

Acidified to between pH 4.0 and 4.5 with 26 milliliters (ml) of 3.4 normal hydrochloric acid per kilogram (kg) and stored in metal containers for 8 days at 13° C., the meats were taken to a pet food manufacturing plant and stored overnight at 8° C.

The containers were opened and 24 ml of 3.4 normal sodium hydroxide per kg of liquid egg were stirred into the mixture. Egg meats were cooked by live steam until they reached solid or dry scrambled egg texture. They were then incorporated into cans of specialty dog food and put under 20 pounds steam pressure for 50 minutes.

Feeding tests were run to compare the experimental food with a commercially available pet food. The latter used fresh waste egg meats instead of stored meats, but the recipes were the same. Fifteen dogs were offered both samples simultaneously, in a series of three feedings. Dog acceptance was equally good for the test food and the popular commercial brand.

In the future, yesterday's unusable waste egg meats may be Rover's Sunday dinner. □

To determine the effectiveness of various formulations, pheromone-laden bottle caps are placed in checkerboard patterns around traps baited with live females, which Dr. Mitchell inspects. The number of males of the various species trapped enables researchers to determine if the insects were "confused" by the synthetic pheromone evaporating around the "calling" females (0874R1456–30).

Inhibiting sex: Another approach to insect control

ISOLATION, identification, and synthesis of insect sex pheromones gives new hope for an alternative to pesticides for insect control based on attraction.

Another strategy for insect control may be possible because the positive response of some insects to the appropriate sex pheromone is inhibited by a second chemical. Natural inhibitory pheromones play an important role in maintaining reproductive isolation among related species.

For example, ARS entomologist Everett R. Mitchell and his colleagues at the Insect Attractants, Behavior, and Basic Biology Research Laboratory, Gainesville, Fla., noticed that looplure, the cabbage looper sex pheromone, was also attractive to males of a close relative, the soybean looper. This attraction, however, was inhibited in the presence of a live female cabbage looper.

Additional investigations by ARS scientists have further clarified this phenomenon. Entomologist Lonne L. Sower and associates at the Gainesville Laboratory worked with the almond moth and indian meal moth, both of which produce the same pheromone.

This shared pheromone phenomenon may have developed because the insects have a common ancestry or shared a common habitat. In any case, attempts at interspecific mating would not be productive, leading ultimately to destruction of the species. These insects have evolved with a natural mechanism to combat this danger.

It had been known that female almond moths produced a chemical that appeared to inhibit sexual behavior in male indian meal moths and vice versa. The scientists isolated and synthesized the chemical produced by indian meal moths that inhibited almond moths and found it approximates the effects of the natural substance.

Similar investigations were conducted with the lesser peachtree borer and peachtree borer by chemist James H. Tumlinson and his colleagues at Gainesville and at the Southeastern Fruit and Nut Research Station Laboratory, Tifton, Ga.

They found that when pheromone of the lesser peachtree borer is mixed in a 1:1 ratio with pheromone of the peachtree borer, it inhibits the response of the peachtree borer. And even small amounts of peachtree borer pheromone inhibited the response of the lesser peachtree borer to its own pheromone. These pheromones have also been isolated, identified, and synthesized.

In both cases, the mechanism served to assure reproductive isolation of the species and contribute to their survival. This disruption of male response to sex pheromones could be used to block reproduction and control pests.

An area, for example, might be saturated with peachtree borer pheromone. This might confuse the peachtree borer males who would have trouble distinguishing synthesized pheromone from a pheromone-producing female. In addition, the presence of peachtree borer pheromone in the area would also inhibit sexual response of lesser peachtree borer males.

While application of these findings to practical insect control programs will require further investigation, this research is an important addition to an overall program of analyzing compounds that affect insect behavior. □

In field tests, synthetic pheromone is placed in plastic bottle caps. The pheromone slowly evaporates and the vapors are spread by the wind (0874R1456–35).

Attacking salinity on irrigated lands

The ability of electrically driven sprinkler systems to deliver varying amounts of water makes them ideal for the ARS research being conducted in the Grand Valley to determine the effects of salinity on irrigation management along the Colorado River Basin and on other arid lands where irrigation is required (0874R1403–16).

USING the word "excited" in referring to agricultural scientists may be treating semantics a little loosely but it closely describes researchers involved with irrigation and salinity management along the Colorado River Basin and elsewhere.

Entirely new concepts of increasing irrigation efficiency with the object of raising the quality and quantity of water available in the river basins are under study by ARS.

Field studies are being conducted at Grand Valley, Colo., and Tacna, Ariz., based on research coming out of the U.S. Salinity Laboratory, Riverside, Calif. At the Laboratory, ARS scientists found that in studies of crop response to salinity more emphasis should be placed on the salinity of the irrigation water rather than on the salinity of the soil water as in the past.

When crops are irrigated, plants take up some of the water, some is lost through evaporation, and some drains through the soil and goes back to the river or filters down to ground water.

All natural waters used for irrigation contain some salt. Evaporation and plant use concentrates the salt in the fraction of water left in the soil.

Since too much salt can cut yields of crops, traditional practice has been to leach these salt concentrations out of the field by putting on excessive amounts of water. The salts are moved down and are taken off in the drainage water, oftentimes returning to the river and creating problems for irrigators or other downstream users.

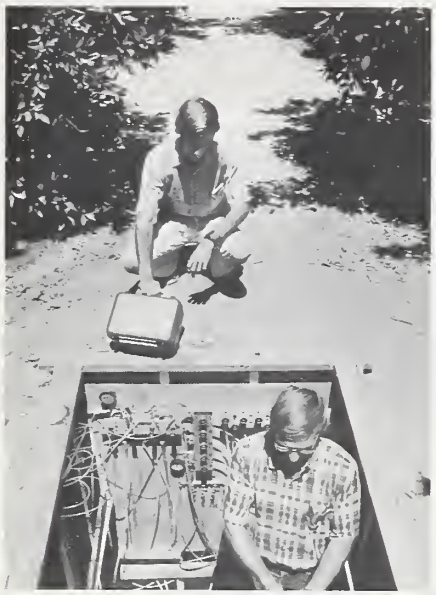
ARS plant physiologist, Leon Bernstein, in studies at the Salinity Labora-

Salt crystals in this soil sample show evidence of the problem farmers have to deal with in the Colorado River Basin and on many other irrigated lands (0874R1407–27).

ATTACKING SALINITY

Below: Mr. Fischbacher checks soil moisture pressure using one of the many measuring devices scattered throughout the experimental plot (0874R1404–22).

Above: *Soil samples are taken frequently for comparison with readings from equipment buried in the test field. Biological technician Gordon Fischbacher takes a sample that will be analyzed for soil moisture, salinity, and CO_2 content (0874R1399–21A).*
Right: *Mr. Fischbacher takes a salinity reading from the reservoir which feeds the sprinkler system. The 27-acre experimental plot is in the background (0874R1405–7).*



Center: Chemist Robert Ingvalson inspects the drip system and tensiometers under a tree. While it is called drip, water actually squirts at 1-foot intervals from a tube coiled around the base of the test tree. The tensiometers measure soil-water suction at 15, 30, 45, and 60 centimeters (cm) beneath the trees. Other tensiometers set at 30 cm under the trees sense when a predetermined "dryness" is reached and activate the drip system for that particular test area (0874R1408–14). Left: Soil scientist James Wood watches as Dr. Ingvalson examines vacuum regulators which collect moisture through tubes located at a 4-foot depth below the entire test area. The moisture is analyzed for volume and chemical content (0874R1407–34). Below: Dr. Ingvalson checks a control point which can be set to deliver different amounts of irrigation water to different areas while Dr. Wood takes a salinity reading from an underground sensor (0874R1409–30).

tory, found that a crop—in this instance, alfalfa—gets most of its water from roots in the top portion of the soil profile. He also found that as long as the irrigation water is of good quality, the plants can tolerate much more salinity near the bottom of the root zone than had previously been believed.

Management, however, plays a key role because the irrigation water must be precisely applied. The water must penetrate the soil uniformly throughout the field. In operational terms, reducing the leaching fraction—the "excessive" amount over and above what is needed for plant use and evaporation—will result in a reduced quantity of salt discharged. The practice changes the composition of the discharged salt, and as much as 30 percent is precipitated into chemically inactive salts such as lime and gypsum. Dr. Bernstein says that at this point an equilibrium can be established that can be maintained over long periods of time.

With this in mind, ARS scientists in Colorado and Arizona are irrigating more often with less water, cutting the volume of water returning to the river or water table as drainage. By using this method, the researchers say a substantial amount of salt will be precipitated harmlessly in a lower part of the root zone, staying in the field and out of the river or ground water.

In Colorado, in cooperation with the Bureau of Reclamation, ARS has installed a 600-foot radius electric-drive pivot sprinkler that irrigates 27 acres of corn. The circular field is divided in six pie-shaped segments with two replications of three leaching fractions—.05, .10, and .15. Although full-scale evaluations began this year, tests last year were judged quite successful. Corn yields compared favorably with surrounding fields, water application rates and leaching fractions were about what was designed for the system, and preliminary data on salinity showed encouraging trends.

In Arizona, in cooperation with the Environmental Protection Agency, ARS

Lysimeters buried beneath the test plots check moisture use of the plants and underground water flow. Agricultural engineer Dennis Kincaid checks one of the three load cells that, despite being under 10 tons of soil, can detect a "heavy dew" (0874R1401–1).

scientists have set up projects for trickle irrigation of citrus and sprinkling alfalfa with a moving modified trickle system. Research on the citrus plots was started a year ago. Research on the alfalfa plots is beginning now.

Irrigation on the Arizona plots is controlled automatically by "querying" tensiometers on a regular time schedule. Salinity sensors relay information that is used to set tensiometers to maintain given salinity levels in the fields.

Jan van Schilfgaarde, Director of the Salinity Laboratory, said, "We can visualize an irrigation management system that, compared to conventional practices, results in a reduced volume of water applied and a reduced quantity of salt discharged in a reduced drainage volume, while maintaining crop yields.

"In view of the increasing interest in water quality and the substantial impact of irrigation on the salt concentration in some of our Western rivers, such observations are particularly timely. They suggest that it is possible, by changes in irrigation management, to greatly reduce the amount of salt discharged from irrigation projects," Dr. van Schilfgaarde said.

"These observations also indicate, that, in some circumstances, it may be feasible to dispose of reduced amounts of highly concentrated drainage water by methods other than returning it to streams in order to take some of the salt out of the subsystem. Evaporation ponds or bypass channels may become feasible alternatives for alleviating salt pollution if the volume of drainage water is sufficiently small." □

EKG transmitter proves versatile

TUCKED AWAY in the webbing of his helmet, a 200-pound University of Georgia football player wore a half-ounce radio transmitter originally designed to monitor the EKG of a chicken.

Illustrating how research on animals can be applied to human health, scientists have shown that an EKG or electrocardiogram of both an athlete and a chicken can be successfully measured and transmitted by a tiny radio telemetry transmitter. The telemetry transmitter is capable of measuring and transmitting physiological data by radio to a distant receiver where it can be recorded.

Although some telemetry transmitters are now available commercially for monitoring dynamic EKGs of humans, they are generally used in coronary care units for monitoring patients. Most of them are too bulky for use by football players and swimmers, and they have the limitation of fixed or one frequency tuning. They are also expensive.

The biotelemetry system developed and constructed for use on chickens by ARS agricultural engineer Bailey W. Mitchell, Southeast Poultry Research Laboratory, Athens, Ga., has literally "run with the ball." It can monitor EKGs of athletes playing football, volleyball, running track, swimming, and undergoing treadmill tests. Parts for the miniature transmitter cost about $15, and it can be built by an electronic technician in a day and a half. The entire monitoring system weighs approximately 43 pounds and its various components can be easily carried by two men.

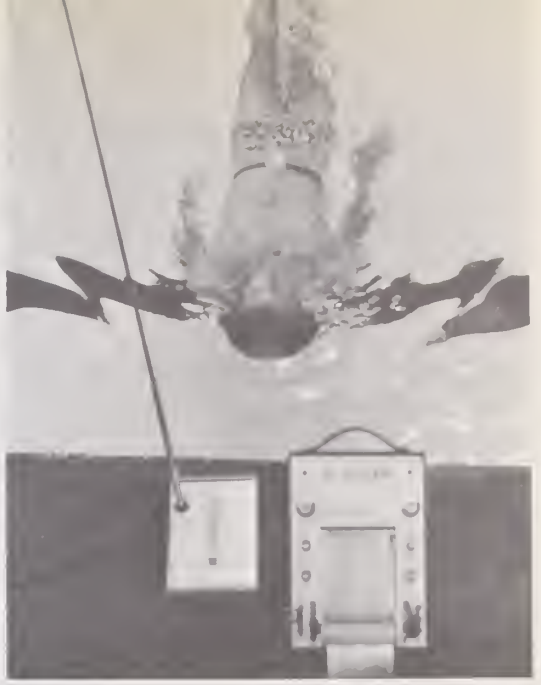
"The system itself—combination receiver and transmitter—costs around $400 compared to $1,200 to $1,300 for commercial systems. The transmitter alone, including labor, costs about $80 compared to $300 to $500," Dr. Mitchell said.

"Its wide tuning range is an equally big advantage. It crosses the entire FM band from 88–108 megacycles. This range allows us to use several transmitters with one receiver by tuning alternately from one to the other."

In EKG studies on chickens infected with Newcastle disease or exposed to heat stress, the chickens are free to move around in a four-tiered cage—or if floor reared, in a floor pen. The transmitter is attached by two strings between the wings and sits on the chicken's back.

To monitor a football player, the transmitter was wrapped in two or three layers of thin foam rubber to reduce the effects of shock and taped inside his helmet. A small receptacle for the electrode jack was placed at the lower rear of the helmet.

During volleyball or track events, the transmitter was wrapped in a thin piece of foam rubber and put into a small plastic pill container worn under a sweat band on the head. The electrodes were applied before vigorous activity when the skin was dry, shaved, and scrubbed with alcohol. Pads with adhesive on both sides held the electrodes in place. The electrodes, 2.5 centimeters in diameter, had recessed silver disks so that electrical contact between the skin and the electrode was made by the electrode paste.



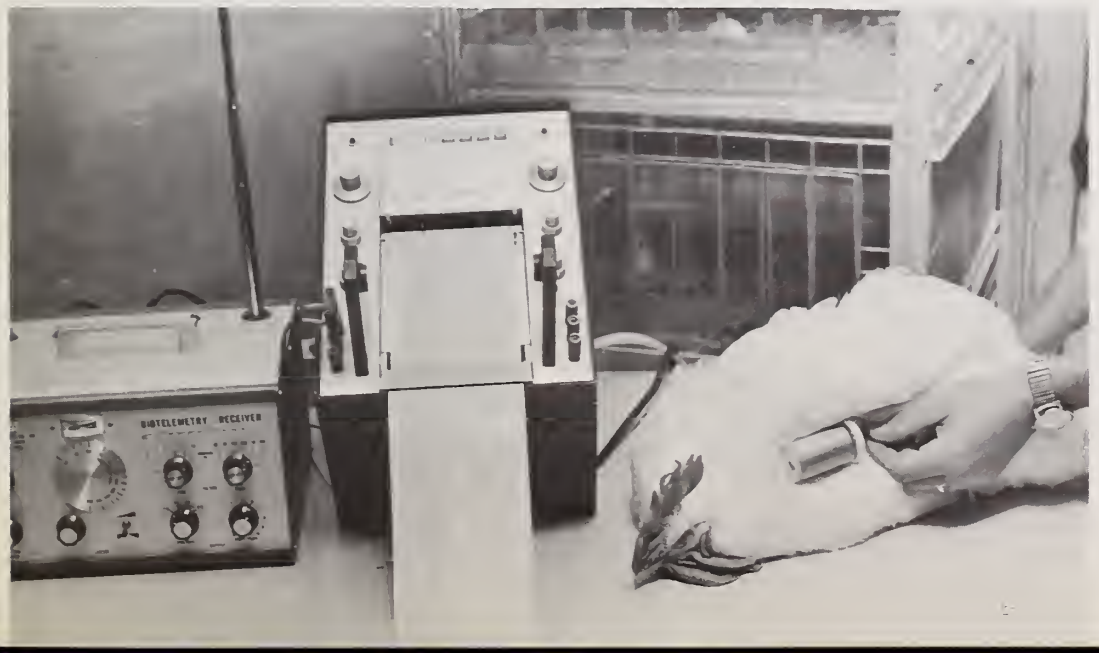
Designed originally to monitor the EKG of a chicken, this ½ ounce radio telemetry transmitter has been used to transmit physiological data from athletes competing in swimming, football and running at the University of Georgia (0874X1425–10A).

The type of antenna employed depended on distance and obstructions between the subject and the receiver. In monitoring football scrimmages, a directional beam antenna was pointed in the general direction of the subject. For swimmers and runners—at distances up to 75 feet—a built-in 5-foot whip antenna, similar to a radio antenna on an automobile, was adequate.

The system satisfactorily monitored 55 non-athletes and 17 athletes on either the football or swimming team. Athletes reported no interference in their performance while wearing the transmitters.

Dr. Mitchell collaborated on the telemetry tests with Dr. George O. Thomasson, University of Georgia, Health Services, Athens, Ga. □

The small transmitter was designed to be strapped to a chicken to provide data in studies of chickens infected with Newcastle disease or exposed to heat stress. Not being attached to recording equipment, the chickens are free to roam, thus more accurate data is collected under the natural conditions (0874X1424–6A).



Dr. Van Der Maaten examines cell cultures infected with bovine leukemia virus. The virus-bearing cultures are transferred to healthy animals to help ARS scientists identify the leukemia-causing virus (0874X1244–23).

Cattle leukemia linked to virus

THE CAUSE of leukemia in cattle has been tentatively identified after more than a decade of attempts in this country and abroad to determine what biological agent produces the disease.

Research at the National Animal Disease Center, Ames, Iowa, and the University of Wisconsin, Madison, points to a C-type virus, isolated from leukemic cattle, as the causal agent. Most viruses associated with other forms of leukemia are similarly classified by structure as C-type viruses.

Scientists have grown the virus in the laboratory and used it to infect both cattle and sheep. Its identification as the agent responsible for bovine leukemia must remain tentative, however, until scientists can demonstrate tumor production by the candidate virus in lymph tissue of cattle. They may not obtain proof of tumor production for several years, but they are cautiously optimistic.

ARS veterinary medical officers Martin J. Van Der Matten and Janice M. Miller have animals under observation that were inoculated with the virus as calves. The tumors typically do not develop until cattle are 3 to 8 years old, however, and then in only a small proportion of infected animals.

If further research confirms that the candidate virus produces bovine lymphosarcoma, the scientific designation of leukemia in cattle, identification and removal of infected animals from herds might be practical. The disease occurs more often in dairy than beef cattle, usually in widely scattered herds, and its elimination would be desirable for public health reasons.

Difficulty in establishing cell cultures from tumors or white blood cells of affected animals and inability to establish association between previously isolated viruses and bovine leukemia (AGR. RES., Mar. 1969, pp. 8–9) frustrated earlier attempts to identify the causal agent.

A short-term lymphocyte culture technique, the first satisfactory method for culturing and testing for the presence of C-type virus in cattle, opened the way for recent progress. This technique was developed by Janice M. Miller, then at the University of Wisconsin, in association with Lyle D. Miller, Carl Olson, and Kenneth G. Gillette of the University.

The researchers identified the C-type virus in inocula prepared from cultures established by this technique and later confirmed that infection had been established in experimentally inoculated cattle.

The NADC-Wisconsin research has developed a potential diagnostic technique, a gel-diffusion test, that identifies antibodies to the candidate virus in blood serum of infected cattle. The test, developed by Dr. Janice Miller and Dr. Olson, was an essential research tool in providing evidence that infection with the C-type virus is the same disease as bovine leukemia.

With the test, the researchers showed that (1) most leukemic cattle have antibodies to C-type virus antigens, (2) antibodies are frequently found in apparently normal cattle in herds that have had multiple cases of leukemia, and (3) antibodies occur much less frequently or are absent in cattle from herds in which the disease has not been diagnosed.

With the ability of the virus to produce tumors in cattle yet to be demonstrated, the scientists are encouraged by studies showing its tumor-producing ability in sheep, a species in which leukemia rarely occurs.

In 1972, Dr. Olson, Dr. Lyle Miller,

Dr. Janice Miller, and Herbert E. Hoss of the University of Wisconsin inoculated 13 newborn sheep. Of 11 which became infected, to date six have developed lymphoid tumors and died. Gel-diffusion tests confirmed that the virus reisolated from the sheep tumors was the bovine C-type virus.

Further progress in study of the disease should be aided by a recently developed laboratory method for growing the virus in monolayer cell cultures of tissue from leukemic cattle. Large-scale concentration and purification of the virus now promises a continuous supply of the virus in contrast to the previously used lymphocyte culture technique. Virus production was limited in the earlier method, and cell degeneration accompanying virus release made re-establishment of cultures necessary every 2 or 3 days. Studies by Dr. Van Der Maaten, Dr. Janice Miller, and Arliss D. Boothe at Ames confirm that the same C-type virus is produced by both culture techniques.

Further studies may confirm the candidate virus as the cause of the disease, lead to detailed description and classification of the virus, and determine its relationship to other viruses. □

Veterinarian Janice M. Miller inspects an agar gel-diffusion plate to determine the results of a test she developed to identify cattle infected with bovine leukemia virus (0874X1240–16A).

Whitefringed beetles: Controlling a nursery pest

THE WHITEFRINGED BEETLE is a feminst par excellence in the insect world—there are no males and the female reproduces asexually—but she may get her comeuppance from an effective larvicide tested by researchers.

Although the whitefringed beetle damages peanuts, watermelons, and other truck crops, damage in recent years has occurred only sporadically. Infestation is most visible in numerous popular flowering plants, among them azaleas, camellias, and hydrangeas. Reproducing asexually, a single beetle in a hedge plant will ensure wide propagation.

Beetle populations attack semitropical plants from Florida to Virginia, Missouri, and Texas. Most quarantine regulations require that nursery plants grown on untreated land must be dipped in an accepted insecticidal solution before the plants can be moved.

Resistant to the accepted insecticide dip treatment—a solution of pyrethrinpiperonyl butoxide—the whitefringed beetle has survived State and Federal quarantine measures. In some areas, chlorinated hydrocarbon insecticides such as dieldrin have been used in the soil instead. ARS research entomologist Donald P. Harlan has reported whitefringed beetle larvae also resistant to dieldrin. Last October, however, the Environmental Protection Agency proposed a suspension on the manufacture and use of dieldrin. The proposed suspension met with some opposition and has been appealed in the courts by several groups.

To find an effective treatment and to determine the degree to which it could be poisonous to plants. Dr. Harlan, assisted by colleagues from Gulfport, Miss., and Animal and Plant Health Inspection Service scientists from Mobile, Ala., conducted screening tests with 16 existing compounds in Mobile County, Ala., where the larval resistance to dieldrin had been demonstrated.

Two-year-old small shrubbery plants were obtained from local wholesale nurseries in 1-gallon containers in a mixture of sandy loam soil, peat moss, and pine bark. Ten large prepupal larvae were introduced through the top and holes in the bottom of the pots. Then the 16 compounds—some proprietary products and some common-named compounds like parathion and carbofuran—were tested as dip solutions prepared by adding the necessary amount of insecticide to 10 gallons of water. The plants were dipped for 15 minutes. Then the plants were maintained outdoors in a shaded area on a polyethylene sheet for periods of 2 weeks and 4 weeks posttreatment.

When the plants were removed from the containers, the soil was washed through a series of screens to recover the larvae. Only one compound, known commercially as Abate, (4,000 parts per million in water) gave 100 percent kill 4 weeks posttreatment.

Tested on 90 plant species and varities to determine toxicity, the dip appeared to be poisonous to only 3 plant varieties, all azaleas in the rhododendron family. "Even those sensitive varieties recovered within one month posttreatment," said Dr. Harlan.

Dr. Harlan also determined that any addition of piperonyl butoxide to the compound did not aid larval mortality, but, instead, lowered the efficiency of Abate.

After a 30-day holding period following treatment, no live larvae were found in the plants.

Because the dip also proved to be effective at a wide range of temperatures, it can be used year-round, Dr. Harlan said. □

1974 INDEX

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PUBLIC DOCUMENTS DEPARTMENT, WASHINGTON, D.C. 20402

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